REMARKS

By the present Amendment, claims 1 and 10 have been amended. No claims have been added or cancelled. Accordingly, claims 1-10 remain pending for examination. Claims 1 and 10 are independent.

In the Office Action of August 29, 2011, claims 1-3, 5, and 10 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 7,274,363 issued to Ishizuka et al. ("Ishizuka") in view of U.S. Patent No. 6,243,061 issued to Sandoe et al. ("Sandoe"). Claim 4 was rejected under 35 USC §103(a) as being unpatentable over Ishizuka in view of Sandoe, and further in view of U.S. Patent Application No. 2002/0030647 to Hack et al. ("Hack"). Claims 6 and 7 were rejected under 35 USC §103(a) as being unpatentable over Ishizuka in view of Sandoe, and further in view of U.S. Patent No. 6,518,962 issued to Kimura et al. ("Kimura"). Claims 8 and 9 were rejected under 35 USC §103(a) as being unpatentable over Ishizuka in view of Sandoe, and further in view of U.S. Patent No. 6,414,443 issued to Tsuruoka et al. ("Tsuruoka"). These rejections are respectfully traversed.

Claims 1-3, 5, and 10 were rejected under 35 USC §103(a) as being unpatentable over Ishizuka in view of Sandoe. Regarding this rejection, the Office Action indicates that Ishizuka discloses a display apparatus that includes a pixel array including a plurality of pixels. Each pixel is indicated as including a light emitting unit, a drive element, and a switching element for controlling the drive element. The Office Action further indicates that the display apparatus includes a data signal drive circuit for receiving image data for each frame period, a scanning signal drive circuit for outputting a scanning signal, and a current source.

The Office Action admits that Ishizuka fails to disclose a control circuit for increasing a voltage applied to the light emitting unit while pixels with small gray

scale numbers are emitting no light and pixels with large gray scale numbers are emitting light within each frame period. Sandoe is relied upon for disclosing a control circuit for continuously increasing a voltage applied to a light emitting unit while pixels with small gray scale numbers are emitting no light and pixels with large gray scale numbers are emitting light within said each frame period. The Office Action concludes that it would have been obvious to combine the teachings of Ishizuka with those of Sandoe in order to arrive at the claimed invention. Applicants respectfully disagree.

By the present Amendment, Applicants have amended independent claim 1 in order to better clarify the invention with respect to features that are not believed to be shown or suggested by the art of record. As currently amended, independent claim 1 defines a display apparatus that comprises, in part:

> a control circuit for increasing a light emission time period within said each frame period with increasing gray scale number, and increasing a voltage applied to said light emitting unit continuously after an end of a light emission time period corresponding to a predetermined gray scale number within said each frame period,
>
> wherein each frame period includes said light emission time period and a non-light emission time period after said light emission time period.

Accordingly, the display apparatus of independent claim 1 now includes a control circuit for increasing a light emission time period within each frame period with increasing gray scale number. The control circuit also increases the voltage applied to the light emitting unit continuously after the end of a light emission time period corresponding to a predetermined gray scale number within each frame period. Each frame period includes the light emission time period and a non-light emission time period which follows the light emission time period. Thus, the voltage

applied to the light emitting unit is continuously increased during the non-light emission period.

Referring to Fig. 17, for example, consider a display apparatus having 64 gray scale levels, from gray scale number 0 to gray scale number 63, are to be displayed. As shown in the Figure, one frame period includes a light emission period and a non-light emission period. See paragraph [0083] of the published application. All pixels other than the pixel whose light emission time period is 0 begin to emit light at time T0. As time elapses, the pixels sequentially stop emitting light in the order of increasing gray scale number. Thus, the pixel whose gray scale number is 1 is the first to stop emitting light, while the pixel whose gray scale number is 63 is the last to stop emitting light. Accordingly, it becomes possible to control the light emission time period according to the gray scale level to provide a gray scale display. Referring additionally to Fig. 18, it can be seen that the light emission time period within each frame period increases with increasing signal voltage level.

According to the arrangement of independent claim 1, only the pixels with high gray scale values are controlled to emit light at a high luminance level, thereby enhancing both the peak luminance and visual impact of the display screen. Furthermore, the display synchronous cathode potential circuit (27) does not apply any high voltage to the organic EL elements (24) while the pixels with low gray scale values are emitting light. This makes it possible to prevent a black display from becoming tinged with white and enhance the contrast. See paragraph [0085]. Additionally, a high voltage is only applied to bright pixels, while a low voltage is applied to the other pixels, thereby reducing the overall voltage stress on the organic EL elements while maintaining a comparatively high peak luminance level.

Accordingly, the display apparatus of independent claim 1 makes it possible to effectively reduce degradation of the organic EL elements.

The Office Action alleges that the combination of Ishizuka and Sandoe discloses all of the features recited in independent claim 1. Applicants respectfully disagree with this conclusion. It is again noted that the Office Action admits the failure by Ishizuka to disclose a control circuit as set forth in the claimed invention. However, Applicants' review of Sandoe also suggests a failure to disclose a control circuit as set forth in the claimed invention. Sandoe discloses an active matrix display device having two terminal non-linear switching devices connected in series with the electro-optic (e.g. LC) display elements between associated row and column address conductors. The display elements are driven using pulse width modulated data signals, and a range of grey-scale levels is achieved by using selection signals whose form is determined such that the current flow through the switching devices upon selection is controlled in an appropriate manner. Although Sandoe discussed application of a voltage at increasing levels, this is done in a manner which differs from that of the claimed invention.

At the outset, Applicants note that Sandoe does not appear to provide a frame period which consists of light emission time period and a non-light emission time period. Furthermore, Sandoe indicates that the use of PWM data signals leads to almost constant current charging of the display elements. Specifically, Sandoe initially increases the voltage on the row conductor 16 rapidly at the start of a row address period Ts, corresponding to the leading edge of the selection signals S+ or S-. This is done until current begins to flow through the switching device 15. The voltage on the row conductor is then increased, during the ramp portion of the selection signal, more slowly and linearly in order to maintain this current. See

column 11, lines 49-64. Sandoe goes on to indicate that the voltage on the column conductor 17 is such that current will flow through the switching devices 15 at the beginning of the row selection signal (S+ or S-), and thereafter is maintained for the required charging period, to provide the desired display effect, before then being switched to a level at which current flow ceases.

There is no disclosure or suggestion for increasing the light emission time period within said each frame period with increasing gray scale number, and increasing a voltage applied to said light emitting unit continuously after an end of a light emission time period as set forth in the claimed invention. In particular, since there is no disclosure for a frame period which consists of light emission time period and a non-light emission time period, it is to be expected that the feature of the control circuit would also be lacking. Thus, even if combined, the combination of cited references still fail to provide any disclosure or suggestion for features now recited in independent claim 1, such as:

> a control circuit for increasing a light emission time period within said each frame period with increasing gray scale number, and increasing a voltage applied to said light emitting unit continuously after an end of a light emission time period corresponding to a predetermined gray scale number within said each frame period,
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> wherein each frame period includes said light emission time period and a non-light emission time period after said light emission time period.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-9 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim

1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

By the present Amendment, Applicants have also amended independent claim 1 to define a method for displaying an image based on image data by using a pixel array that includes a plurality of pixels. Each of the pixels includes a light emitting unit, a drive element for controlling the supply of current to the light emitting unit, and a switching element for controlling the drive element according to an image signal. The method comprises, in part:

> increasing a light emission time period within said each frame period with increasing gray scale number, said each frame period including said light emission time period and a non-light emission time period after said light emission time period; and
>
> increasing a voltage applied to said light emitting unit continuously after an end of a light emission time period corresponding to a predetermined gray scale number within said each frame period.

Thus, similar to independent claim 1, the method of independent claim 10 now recites a step of increasing a light emission time period within each frame period with increasing gray scale number, with each frame period including the light emission time period and a non-light emission time period after the light emission time period. Additionally, independent claim 10 provides a step of increasing a voltage applied to the light emitting unit continuously after an end of a light emission time period corresponding to a predetermined gray scale number within each frame period. As previously discussed, these features are not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 10 is allowable over the art of record.

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 1497.43143X00).

Respectfully submitted,
ANTONELLI, TERRY, STOUT & KRAUS, LLP.

/Leonid D. Thenor/
Leonid D. Thenor
Registration No. 39,397

LDT/vvr
1300 N. Seventeenth Street
Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666

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